CASE STUDY: Sustainable Building

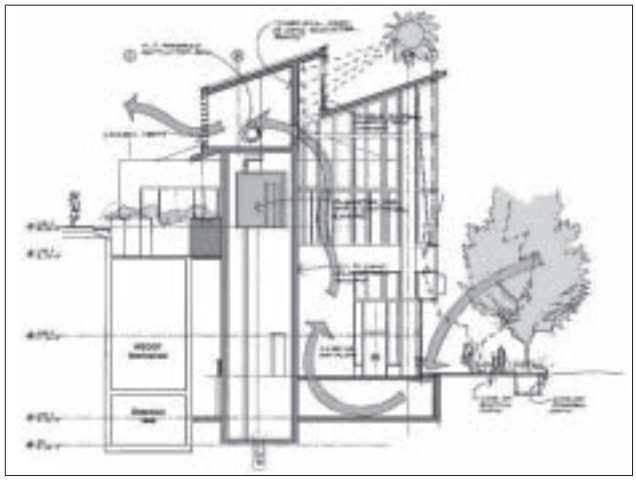
key tower base remodel

using nature as a guide to energy efficiency

INFORMATIONAL SUPPLEMENT FOR DCLU CUSTOMERS

In our previous case study we focussed on the Cedar River Watershed, the primary source of water for 70 percent of the 1.3 million people living in the greater Seattle area. The Watershed's Education Center was constructed using sustainable building methods designed to protect the watershed and conserve water. This month's feature addresses the energy-saving remodel currently underway on the base of Key Tower, the downtown offices for a good portion of City employees and services.

On September 30, 2002, the City of Seattle will began an extensive reworking of the Southwest entrance to Key Tower at 700 Fifth Avenue. The new entrance vestibule—which is designed to improve the flow of pedestrian traffic, increase safety, strengthen the connection between Key Tower and the City's new Civic Center, and create a new identity for the building—will take full advantage of natural ventilation and passive solar, thereby foregoing the need for heating or air conditioning.



By borrowing from the building practices of nature's master architect—the termite (see page 8)—the newly remodeled Key Tower base will provide thermal comfort and ventilation in the vestibule without using energy for heating or air conditioning. The passive mechanical system was designed by KEEN Engineering.

The project team led by Jun Quan, AIA, project manager from the Architecture, Engineering & Space Planning Division within Seattle's Fleets and Facilities Department, and the architect, Hewitt Architects, improved accessibility with a creative design solution—simplifying the circulation paths by replacing a number of the existing pathways into Key Tower at the Southwest corner with one clear entry into the building. Disabled access will also be enhanced by an elevator that serves as a hill-climb assist from the 5th Avenue entry to the 6th Avenue Plaza. Additionally, the east sidewalk along 5th Avenue will be widened and lined with street trees and landscaping to create a more pedestrian feel.

The new entry is an unconditioned vestibule enclosed with glass and bathed in daylight. An escalator will take people from the entry to the daylight atrium on Level 4, with the pathway defined by the light shining into each distinctive space.

Nature's Laws, Strategies & Principles

Nature runs on sunlight

Nature uses ony the energy it needs.

Nature fits form to function.

Nature recycles everything.

Nature rewards cooperation.

Nature banks on diversity.

Nature demands local expertise.

Nature curbs excesses from within.

Nature taps the power of limits.

See **key tower base remodel** *on page 8*

key tower base remodel, *cont. from page 7*

Borrowing from Nature's Master Architect, the Termite

The Key Tower remodel design team borrowed from one of nature's master architects—the termite—to provide thermal comfort and ventilation in the vestibule without using energy for heating or air conditioning. The innovative approach will use thermal mass, natural ventilation and passive solar design strategies.

In *Evolutionary Architect: Nature as a Basis for Design*, Eugene Tsui reflects that "the process of construction, the materials and correct combination of materials to yield an elegant, structurally efficient and durable structure is simply awe-inspiring." Termite towers consist of hard, double skin walls similar to concrete manufactured from local soil and saliva. The walls help control the temperature and humidity by sealing in moisture and keeping heat out (much like the west facing "buffer wall" on Seattle's recently completed Justice Center). Air is circulated through a system of channels and ducts, and ventilation holes or pores supply fresh air and exhaust stale air. This sophisticated system is powered by heat and gravity, hot air rises and is exhausted while cool air falls.

The form and orientation of termite towers are responsive to the climate, featuring overhangs in regions with heavy rains and an east/west solar orientation in hot, dry regions. In Africa and Australia termites dig wells to underground water sources; some wells are more than 125 feet deep and provide cooling much like our geothermal ground coupled heat pumps.

The Key Tower entrance vestibule uses concrete as thermal mass to store cold during the summer and heat during the winter. During the summer, the supply air flows through a concrete chamber under the vestibule. The concrete, cooler than the temperature outside, will cool the air as it flows across its mass. As the air heats up in the vestibule it will naturally rise. Louver vents are located near the roof and exhaust the hot air assisted by a photovoltaic powered ventilation fan.

The Key Tower base remodel team used computer modeling tools to analyze solar heat gain and glare during the summer months. The results demonstrated that the dominant sun angle will be blocked by the Columbia Tower and that the space will be sufficiently comfortable for its intended use.

During the winter the system is reversed. The thermal mass heats incoming air and the cold outside air is warmed as it enters by heat stored in the concrete mass. The louver vents located near the roof are closed to keep warm air from escaping, and solar heat gain provides some additional heat during the day.

Termite Tower Tidbits

- ***Did you know that termites construct the tallest non-human structures on the planet? In relative size a termite tower reaches heights equivalent to a 180-story highrise. For comparison, the Columbia Tower—Seattle's tallest building—is 76 stories tall.***
- ***According to Janine Benyus, author of the book* Biomimicry, *"Our central heating and air-conditioning are bested by the termite tower's steady 86 degrees F."***

Learn More about Sustainable Building

To learn more about the City's Sustainable Building Program visit **www.cityofseattle.net/sustainablebuilding**. And to explore DCLU's involvement in sustainability goals visit **www.cityofseattle.net/dclu/sustainability**, or contact:

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